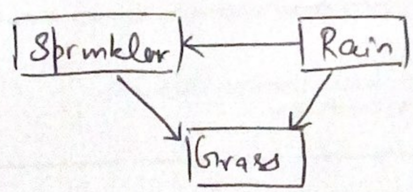
Explanation :

→ Given dataset A & dataset B & the graphical/Model Now we must use the Dataset A to train the graphical model to estimate the probabilities in the $cond^n$ probability table.

→ When we consider the Bayesian belief Network, "Nodes" in the graph are treated as "Variables", "Arrows" represent the "dependence of variables".

→ Given graphical model is



From this graph, we can observe that, "Rain" is the root node (check the arrows) & it is independent.
Child Nodes are Sprinkler & Grass which are (2) dependent on Rain, & if we consider Grass it is also a child of sprinkler & is dependent on.

→ Let us consider Dataset A

Model/Varible "Rain":-

In the Rain column, the Data Contains

Yes = 4

No = 12

∴ Probability for Rain $P(Rain=Yes) = 4/16 = 0.25$

$P(Rain=No) = 12/16 = 0.75$

Similarly Consider

Sprinkler : Here sprinkler is a dependant of Rain, so the conditional probilities considered will be as follows:

① $P(\text{Sprinkler}=\text{Yes} \mid \text{Rain}=\text{Yes}) = \dfrac{P(\text{Sprinkler}=\text{Yes}, \text{Rain}=\text{Yes})}{P(\text{Rain}=\text{Yes})}$

$= (1/16)/(4/16) = 1/4 = 0.25$

Check all the remaing probabilities:

② $P(\text{Sprinkler}=\text{No} \mid \text{Rain}=\text{Yes}) = \dfrac{P(\text{Sprinkler}=\text{No}, \text{Rain}=\text{Yes})}{P(\text{Rain}=\text{Yes})} = \dfrac{(3/16)}{(4/16)} = 3/4 = 0.75$

③ $P(\text{Sprinkler}=\text{Yes} \mid \text{Rain}=\text{No}) = \dfrac{P(\text{Sprinkler}=\text{Yes}, \text{Rain}=\text{No})}{P(\text{Rain}=\text{No})} = \dfrac{(5/16)}{(12/16)} = 5/12 = 0.42$

④ $P(\text{Sprinkler}=\text{No} \mid \text{Rain}=\text{No}) = \dfrac{P(\text{Sprinkler}=\text{No}, \text{Rain}=\text{No})}{P(\text{Rain}=\text{No})} = \dfrac{(7/16)}{(12/16)} = 7/12 = 0.58$

Similarly, Calculate the conditional probabilities for "Grass". Since Grass is dependent on Both sprinkler & Rain check it for both.

$P(\text{Grass}=\text{Wet} \mid \text{Sprinkler}=\text{Yes}, \text{Rain}=\text{Yes}) = \dfrac{(1/16)}{(1/16)} = 1$

$P(\text{Grass}=\text{Wet} \mid \text{Sprinkler}=\text{Yes}, \text{Rain}=\text{No}) = \dfrac{(2/16)}{(3/16)} = 2/3 = 0.67$

$P(\text{Grass}=\text{Wet} \mid \text{Sprinkler}=\text{No}, \text{Rain}=\text{Yes}) = \dfrac{(4/16)}{(5/16)} = 4/5 = 0.80$

$$P(\text{Grass} = \text{Wet} \mid \text{Sprinkler} = \text{No}, \text{Rain} = \text{No}) = \frac{(0/16)}{(7/16)} = 0/7 = 0$$

$$P(\text{Grass} = \text{Dry} \mid \text{Sprinkler} = \text{Yes}, \text{Rain} = \text{Yes}) = \frac{(0/16)}{(1/16)} = 0/1 = 0$$

$$P(\text{Grass} = \text{Dry} \mid \text{Sprinkler} = \text{Yes}, \text{Rain} = \text{No}) = \frac{(1/16)}{(3/16)} = 1/3 = 0.33$$

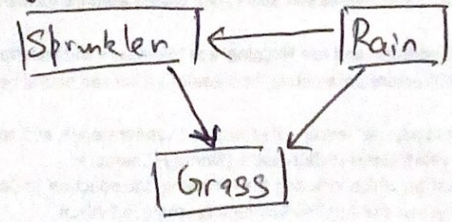
$$P(\text{Grass} = \text{Dry} \mid \text{Sprinkler} = \text{No}, \text{Rain} = \text{Yes}) = \frac{(1/16)}{(5/16)} = 1/5 = 0.2$$

$$P(\text{Grass} = \text{Dry} \mid \text{Sprinkler} = \text{No}, \text{Rain} = \text{No}) = \frac{(7/16)}{(7/16)} = 1$$

→ From the above calculated conditional probabilities the Joint Probability Distribution is given as follows:

P(Sprinkler)

Rain	Yes	No
Yes	0.25	0.75
No	0.42	0.58



	P(Rain)
Yes	0.25
No	0.75

P(Grass)

Sprinkler	Rain	Wet	Dry
Yes	Yes	1	0
Yes	No	0.67	0.33
No	Yes	0.80	0.20
No	No	0	1

Check all the remaining probabilities